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EFFECTS OF PLATESCAPES ON PLATE WASTE PERCENTAGE AMONG PATIENTS IN A PUBLIC HOSPITAL IN SELANGOR, MALAYSIA

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The prevalence of plate waste in the hospital setting is concerning as it reflects the patients' nutrition inadequacy. There are many studies conducted to improve hospital plate waste but there is limited study determine the effect of platescapes on plate waste percentage in the hospital setting. Platescapes or the visual physical characteristics of the dinnerware are some factors patients observe during the meal that could mold food behavior and food intake without involving the taste, texture, or quality of the food itself. Therefore, this quasi-experimental study aimed to determine the effect of platescapes (1) Experimental Compartment Blue Tray (CBlT) and Control Compartment Beige Tray (CBgT) and (2) Experimental Blue Plate (BP) and Control White Plate (WP) for Plate Colours Experiment on plate waste percentage during one time lunch hour among patients in a public hospital in Selangor who received a normal diet. This study also determined the interaction of the tray/plate colours and the main effect of socio-demographic characteristics (sex, age, ethnicity, household income, employment status), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food service satisfaction (food quality, meal service and staff issue, customization, physical and social and overall satisfaction) with plate waste percentage. The findings of this study showed that the plate waste percentage in the Tray Experiment was 30.1%. For the Plate Experiment, the total plate waste percentage was 32.5%. There was a statistically significant difference in total plate waste percentage between the plate colours (with lower plate waste percentage was reported in BP group. The highest reason for plate waste reported by patients in the Tray Experiment was due to poor appetite. Interestingly, the Plate Experiment showed the most frequent reason was different food preference/meal taste. The TWO-WAY ANOVA was conducted to determine the interaction between the tray or plate colour with the baseline variables. The result shows that there was only a significant interaction effect found between the plate colours and education level. The analysis of the main effect for the Tray Experiment shows, ethnicity and overall satisfaction were significantly related with plate waste percentage. There were significant effect of food quality and overall satisfaction, with plate waste percentage with the trend of higher food quality or overall satisfaction will

result in a lower plate waste percentage. For the Plate Experiment, the findings show, male was associated with a lower mean of plate waste percentage than female. The oncology ward specialty was associated with a higher mean of plate waste percentage 37.9% than orthopedics. There is a significant main effect between BMI category with plate waste percentage. After controlling for the covariates, the plate waste percentage between the Experimental Blue Plate and Control White Plate remain significant. The result of this study can help health professionals to consider improvising platescapes as part of the strategies to manage inadequacy of food intake issues and plate waste problems in the hospital as well as enliven the dining experience among the patients.

Keywords: platescapes; plate colour; plate waste; patients

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KESAN *PLATESCAPE* KE ATAS SISA PINGGAN DALAM KALANGAN PESAKIT DI HOSPITAL KERAJAAN DI SELANGOR, MALAYSIA

Oleh

SITI AMIRAH SHAHEERA BINTI SHALIHIN

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Prevalens sisa pinggan hospital adalah membimbangkan kerana isu ini secara tidak langsung mencerminkan kekurangan nutrisi pesakit. Banyak kajian telah dilakukan untuk mengatasi isu ini namun kajian mengenai kesan *platescapes* kepada sisa pinggan dalam kalangan pesakit di hospital adalah terhad. *Platescapes* adalah ciri fizikal bekas makanan atau minuman yang boleh diperhatikan dan ciri-ciri ini mampu mempengaruhi pengambilan makanan tanpa perubahan pada rasa, tekstur, atau kualiti makanan itu sendiri. Oleh itu, kajian eksperimental kuasi ini bertujuan untuk menentukan kesan pinggan (1) Eksperimen Dulang Petak Biru (CBlT) dan Kawalan Dulang Petak Kuning Air (CBgT) dan (2) Eksperimen Pinggan Biru (BP) dan Kawalan Pinggan Putih (WP) pada sisa pinggan di sebuah hospital awam di Selangor pada waktu makan tengahari dalam kalangan pesakit yang dihidangkan dengan menu Normal. Kajian ini mendapati bahawa peratusan sisa pinggan bagi Eksperimen Dulang adalah 30.1%. Untuk Eksperimen Pinggan, jumlah peratusan sisa pinggan adalah 32.5%. Terdapat perbezaan yang signifikan bagi jumlah keseluruhan peratusan sisa pinggan antara warna pinggan dengan peratusan sisa pinggan yang lebih rendah dilaporkan dalam kumpulan BP. Faktor utama sisa pinggan yang dilaporkan oleh pesakit dalam Eksperimen Dulang adalah kerana selera makan yang kurang baik. Manakala, Eksperimen Pinggan menunjukkan faktor yang paling tinggi menyumbang kepada sisa pinggan adalah pilihan makanan / rasa makanan yang berbeza. Analisa *TWO-WAY ANOVA* dilakukan untuk menentukan interaksi dan kesan utama antara warna dulang atau pinggan dengan pemboleh ubah variasi. Hasil kajian menunjukkan kesan interaksi yang signifikan hanya dilaporkan untuk analisa antara warna pinggan dan tahap pendidikan. Kesan utama bagi Eksperimen Dulang, laporan menunjukkan, etnik, kualiti makanan dan kepuasan keseluruhan mempunyai kaitan dengan peratusan sisa pinggan. Analisis ANCOVA mengesahkan tidak ada perbezaan yang signifikan antara sisa pinggan bagi setiap warna dulang setelah kawalan analisa umur dan setiap dimensi perkhidmatan makanan sebagai kovariat. Walaubagaimanapun, kajian ini mendapati kesan kualiti makanan dan kepuasan keseluruhan yang signifikan dengan peratusan sisa pinggan. Data menunjukkan bahawa penilaiaan kualiti makanan yang lebih tinggi atau kepuasan keseluruhan akan

menghasilkan peratusan sisa pinggan yang lebih rendah. Manakala, bagi Eksperimen Pinggan kajian menunjukkan, terdapat perbezaan statistik yang signifikan antara pesakit lelaki dan wanita dengan perkaitan lelaki mempunyai peratusan sisa pinggan yang lebih rendah sebanyak 13.5% berbanding wanita. Wad onkologi dikaitkan dengan peratusan sisa pinggan 37.9% lebih tinggi berbading wad ortopedik. Terdapat juga kesan utama yang signifikan antara kategori IJT dengan peratusan sisa pinggan. Terdapat juga kesan umur yang signifikan, skor komposit dan kepuasan keseluruhan dengan peratusan sisa pinggan. Setelah mengawal kovariat, peratusan sisa pinggan antara BP dan WP adalah tetap signifikan. Hasil kajian ini dapat membantu ahli kesihatan profesional untuk mempertimbangkan warna pinggan sebagai sebahagian daripada strategi untuk menguruskan ketidakcukupan masalah pengambilan makanan dan masalah sisa pinggan di hospital serta menambah baik pengalaman makan dalam kalangan pesakit di hospital.

Kata kunci: *platescapes;* warna pinggan, sisa pinggan, pesakit

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Declaration by Members of Supervisory Committee

This is to confirm that:

- The research conducted and the writing of this thesis was under our supervision;
- Supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

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LIST OF ABBREVIATIONS

ACHFPSQ	Acute Care Hospital Foodservice Patient Satisfaction Questionnaire
BMI	Body Mass Index
BP	Blue Plate
CBgT	Compartment Beige Tray
CBlT	Compartment Blue Tray
NRS-2002	Nutritional Risk Screening-2002
MNA-SF	Mini Nutrition Assessment Short Form
MUST	Malnutrition Universal Screening Tool
SNAQ	Simplified Nutritional Appetite Questionnaire
WP	White Plate

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Hospital food is an essential part of medical nutrition therapy for patients' recovery (Rollins & Dobak, 2018; Cardenas et al., 2022). Poor food intake is widely known in acute care patients and can worsen malnutrition thus jeopardizing healing status (Keller et al., 2015). Despite the well-known fact, the complexity of patients' illness, social well-being, psychological, and biological factors are barriers to attain nutrition adequacy (Schiavone et al., 2019). Results from nutritionDay among 9959 adult patients from 2009 until 2015 in the U.S. showed 32.1% of patients ate a quarter of their meal or less (Sauer et al., 2019). Similar findings reported by Chada (2019) in a tertiary hospital in India among 1250 patients that showed there were 56% of patients' hospital food intake was ≤50%. It has been a real challenge in achieving patients' nutritional requirements even among the well-nourished patients in the healthcare setting (Pullen et al., 2018). The socioeconomic implication of patients' nutrition inadequacy does not only lengthen admission days, increased treatment costs but also indirectly caused food waste due to wasted hospital food (Holst et al., 2015; Sauer et al., 2019 and Carino et al., 2020).

One of the Sustainable Development Goals (SDGs) set by the United Nations in 2015 is to achieve responsible consumption by halve per capita global food waste at the retail and consumer level by 2030 (United Nations, 2015). Beretta & Hellweg (2019) showed hospitals contributed the highest volume of avoidable food waste as compared to education, catering, hotels and restaurants setting due to complex factors of the unhealthy population (Alshqaqeeq et al., 2018). Plate waste in hospitals is known to be much higher than in other foodservice settings with the average plate waste weight of 30%, ranged from 6-65% based on results of a review study conducted in 32 worldwide hospitals (Williams & Walton, 2011). A food waste study conducted in 20 hospitals in three regions of Sweden reported highest wastage was from plate waste, 42% as opposed to 36% serving waste, and 22% kitchen waste (Eriksson et al., 2020). Plate waste in a hospital is defined as edible food served that remains uneaten by patients after a meal (Ramesh & Manimegala, 2018). There were two most recent normal diet hospital plate waste studies in the local setting (Aminuddin et al. 2018; Tamby Chik et al., 2019). The study by Aminuddin et al. (2018) was conducted in four east Malaysian public hospitals among 189 patients who reported a plate waste prevalence of 36%. Meanwhile, Tamby Chik et al. (2019) reported high wastage of vegetables and protein wastage (86.7%) respectively with no total plate waste percentage reported which the study was conducted among 256 adults in two public hospitals in Selangor. Both studies confirmed taste and quality are very important factors that influence plate waste. The data gained from the plate waste assessment were useful as a baseline reference for hospital kitchens in developing strategies to reduce plate waste, increase food intake and achieving nutrition adequacy among patients (Ramesh & Manimegala, 2018).

All the issues contributed to plate waste can be summarized under four main broad categories: clinical, food, service and environmental (Williams & Walton, 2011). Common barriers reported were missed meals, not wanting ordered food, loss of appetite, feeling too sick, or even several barriers combined between domains (Keller et al., 2015). There are also other reported underlying factors that might influence plate waste indirectly. It was found, female patients tend to have higher plate waste compared to males (Schiavone et al., 2019). This is true even among the healthy population, women have higher plate waste as women are more sensitive of eating more than intended (Schindler et al., 2010; Koivupuro et al., 2012). Another underlying factor to consider is age. Elderly patients tend to not feel hunger compared to younger patients and this could jeopardize their food intake (Keller et al., 2015). In addition, the low educational background is significantly associated with low energy and protein intake, which indirectly led to plate waste (Kong et al., 2019). This is due to patients' expectations on the standard of the meal quality served may be influenced by the knowledge level which eventually affects the hospital satisfaction and food intake (Aminuddin et. al., 2018). Food quality and hospital food satisfaction are globally associated with low food intake and hospital plate waste (Messina et al., 2012; Schiavone et al., 2019). The factor that influences meal satisfaction is vary depends on the setting, patients clinical condition, hospital menu and individual values of the patients themselves (Miyoba & Ogada, 2019). Meanwhile, poor appetite accounted for 16.9% up to 63.9% contribution of plate waste among hospitalized patients (Schiavone et al., 2019; Chada, 2019; Aminuddin, Vijayakumaran, & Abdul Razak, 2018; Navarro et al., 2016 and Keller et al., 2015). This is expected since patients' appetite is influenced by physical conditions, cognitive impairment, psychosocial stress, drugs causing anorexia, gastrointestinal symptoms or taste alteration that reduce the desire to eat (Grossberg et al., 2010).

Up to now, several attempts have been made to overcome the plate waste issue. The effort to reduce plate waste includes implementing a menu ordering system, portion size adjustment, menu improvements, trolley meal delivery system and increase meal energy density (McCray et al., 2018; Freil et al., 2006; Ofei et al., 2015 and Holst et al., 2015). Meal presentation is another initiative targeted in improving patients' appetite and reducing plate waste (Bauer et al., 2011; Navarro et al., 2016).

There are three levels of influences on food consumption among individuals: macro, immediate and micro-level (Brownell & Horgren, 2003). At the macro-level, the focus is on government regulation, food industry, advertising programs and from the view of hospital food service context, the hospital menu served could be the main influence on patients' food intake. The micro-level influence on food intake is referring to choices made by an individual. Within these macro and micro-levels, there is an immediate level that is often overlooked because it lies between the policy and personal choice (Sobal & Wansink, 2007). This immediate level is referring to four ubiquitous microscale-built environments that influence food consumption; kitchenscapes, tablescapes, platescapes and foodscapes. These microscale scapes concepts are based on the fact that places and objects could mold food behavior and food intake without involving the taste, texture, or quality of the food itself (Nyberg, 2019). From these microscales built environments, platescapes is one of the elements that influence the food intake unconsciously. The term "platescapes" refers to the physical appearance of the food container from which the food is served in view of shape, size and color (Lim et al., 2018). The concept can be applied

in a hospital setting in determining the influence of platescapes, particularly on tray and plate colors, in reducing plate waste in hospitalized patients.

Current gastrophysics research shows enhancing colour contrast is the key to make food presentations look best (Spence, 2017). Evidence shows enhancing visual colour contrast between food and the dinnerware make consumer more alert on the meal intake (Van Ittersum & Wansink, 2012; Piqueras-Fiszman et al., 2013). In a study conducted at a long-term care facility, changing the white plate to high contrast blue and red plate resulted in a 25% increment in food consumption (Dunne et al., 2004). This finding is consistent with other research which found blue crockery significantly increased food intake from 114g to 152g compared to white crockery among acute elderly patients (Bell et al., 2014). It appears that meal appearance gave an overall impression of perceived quality and influence appetite and food intake among hospitalized patients (Sorensen et al., 2012). In one study on perception of meal quality on different plate colors among more than 2000 hospitalized patients, the result showed a positive rating trend for darker meats served on a light plate and light meat (fish and chicken) were positively rated on dark plates (Hannan-Jones & Capra, 2018).

A possible explanation of these consistent findings is due to the simultaneous contrast that makes the meal appear more vivid hence look more appealing (Bruno et al., 2013). The visual contrast between the food and the blue tray and plate colour may enhance the appetizing effect and boost the hospital meal intake among patients. Based on this concept, changing the white plate or beige tray is commonly used to serve the meal in our local hospital and with high contrast colour, could be another initiative in reducing plate waste issue in the hospital setting.

1.2 Problem Statement

Hospital plate waste is associated with a high risk of malnutrition status and poor recovery in clinical outcomes (Rinninella et al, 2019). Even more, hospital waste increases the cost and environmental burden (Curtis et al., 2017; Koivupuro et al., 2012). By changing the visible attributions of food and food containers in terms of colour, form, design, size and any other observable attributions, it can exert influence of perceptions and creates different framing interpretations on the meal (Nyberg, 2019; Sobal & Wansink, 2007). This physical attribution is termed platescapes for the food container and foodscapes for the food (Sobal & Wansink, 2007). A quasi-experimental study related to foodscape among two hundred and six hospitalized patients by Navarro et al. (2016) comparing the standard and improvised version of regular lunch meal's presentation showed an increment in food intake and reduction in waste significantly. The improvised meal presentation was advised and trained by the expertise with the meal changes did not change any budget and ingredients. However, implementing this strategy requires higher trained chef and staff and each meal presentation requires more time to prepare for mass production (Williams & Walton, 2011). Thus, an innovative strategy that enhances patient appetite and improves food intake in the hospital while reducing waste and remaining cost- effective are worthy of further investigation (Prgomet et al., 2019).

In terms of platescape studies, several studies have revealed the significant influence of food container colour on increasing or decreasing food consumption (Zhao et al., 2018; Bruno et al., 2013; Van Ittersum & Wansink, 2012). Nevertheless, these platescapes studies on people's behavior were mostly done among children, university students and usually in a laboratory setting (Piqueras-Fiszman, 2019; Spence, 2017). Limited studies were done among the population with special needs, particularly in the hospital setting (Dunne et al., 2004; Bell et al., 2014); Sorensen et al., 2012); Hannan-jones & Capra, 2017).

Based on the literature search, typical food container colour been studied were red, blue, black and white (Cho et al., 2019; Piqueras-Fiszman et al., 2012; Stewart & Goss, 2013; Hannan-Jones & Capra, 2018). Recent studies were evaluating more colours of gold, green, yellow, purple and colour combinations on taste perception and food intake (Schifferstein et al., 2017; Chen et al., 2019; Hansen, 2020). Based on three platescapes studies in the hospital and elderly care, blue crockery was common plate colour tested and consistently resulted in better food consumption (Bell et al., 2014; Dunne et al., 2004).

By using the same principle of "the first taste is always with the eyes" approach, this study is proposing changing the plate and tray colour to overcome hospital plate waste issue without mass alterations in menu planning, without the extra time required to prepare each plate and without needing special kitchen expertise. The food preparation, menu and presentation are retained to see the real effect of the blue plate or the tray colour on the meal intake.

1.3 Significance of the Study

This study aims to determine the effect of platescapes on plate waste among hospitalized patients as there is limited number of research focused on the influence of platescapes on dietary intake, especially among the unwell population. It is important to fill the gap of knowledge in understanding the platescapes, in view of the influence of plate colour on perception. The outcome could be a guideline in improving food intake among the sick adult population in the real hospital setting. This is in line with the current Malaysian Government project objectives on Zero Waste Program to reduce food waste in hospitals setting. The result of this study may provide a realistic solution with minimal effort and minor changes in the current hospital system. Besides, health professionals can consider improvising platescapes as part of the strategies to manage inadequacy of food intake issues and plate waste problems in the hospital as well as enliven the dining experience among the patients.

1.4 Research Question

1. What are the socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level based on tray or plate colours between experimental and control group among patients?

2. What are the difference between plate waste percentage and the reason of plate waste percentage between the experimental and control group among patients?

3. What are the interaction and main effects of tray or plate colour with socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level on plate waste percentage among patients?

1.5 Objectives

1.5.1 General Objective

To study the effect of platescapes and other factors associated with plate waste percentage among hospitalized patients at a public hospital in Selangor.

1.5.2 Specific Objectives

Tray Colour Experiment:

1. To assess socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level between experimental (compartment blue tray) and control (compartment beige tray) groups among patients.

2. To determine the difference between plate waste percentage and reason of plate waste percentage between experimental (compartment blue tray) and control (compartment beige tray).

3. To determine the interaction and main effects between tray colours and socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level among patients on plate waste percentage.

Plate Colour Experiment:

1. To assess socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level between experimental (blue plate) and control (white plate) groups among patients.

2. To determine the difference between plate waste percentage and reason of plate waste percentage between experimental (blue plate) and control (white plate).

3. To determine the interaction and main effects between plate colours and socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level among patients on plate waste percentage.

1.6 Alternative Hypotheses

Tray Colour Experiment:

1. There is a significant difference between plate waste percentage and reason of plate waste percentage between experimental (compartment blue tray) and control (compartment beige tray).

2. There is significant interaction and main effects between tray colours and socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level among patients.

Plate Colour Experiment:

1. There is a significant difference between plate waste percentage and reason of plate waste percentage between experimental (blue plate) and control (white plate).

2. There is significant interaction and main effects between plate colours and socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level among patients.

1.7 Conceptual Framework

The conceptual framework of this study is visualized in Figure 1.1. The conceptual framework investigates the effect of platescapes on plate waste percentage. Experiment 1 study the effect of compartment beige tray and compartment blue tray while Experiment 2 focus on the effect between the white plate and blue plate on plate waste percentage among adult patients at Hospital Kajang, Selangor.

Different colours of tray and plate were found to influence appetite, satiety, taste and food intake among students, children, elderly and hospitalized patients (Akyol et al., 2018; Risso et al., 2015). In this study, the lower plate waste percentage was expected in the blue tray and blue plate compared to the beige tray and white plate respectively (Spence, 2018; Dunne et al., 2004; Bell et al., 2014). It is impossible to study the effects of tray and plate colour on plate waste while controlling all the external factors that influence plate waste. Thus the external factors of socio-demographic characteristics (age, sex, ethnicity, educational level, employment status, household income), medical background (ward specialty, length of stay), nutritional status (BMI, nutritional risk), appetite level and hospital food satisfaction level among patients that had been found to have associations on plate waste were included in this study and controlled in the statistical analysis (Sorensen et al., 2012; Williams & Walton, 2011; Schiavone et al., 2019). This is important to distinguish the underlying factors that might be indirectly associated with plate waste rather than the colour of tray or plate alone. This study did not compare directly the effect of tray and plate on plate waste percentage as the shape itself influence the taste perception and might affect the food intake. The plate shape or shape of the meal container is part of platescape that can influence individual taste perception (Becker et al., 2011; Ngo et al., 2011). Hence, two different experiment were conducted individually due to different shape of the tray (rectangle, compartment) and the plate (round, non-compartment) focusing only on one of the platescape factor, the effect of the plate colour on plate waste percentage.

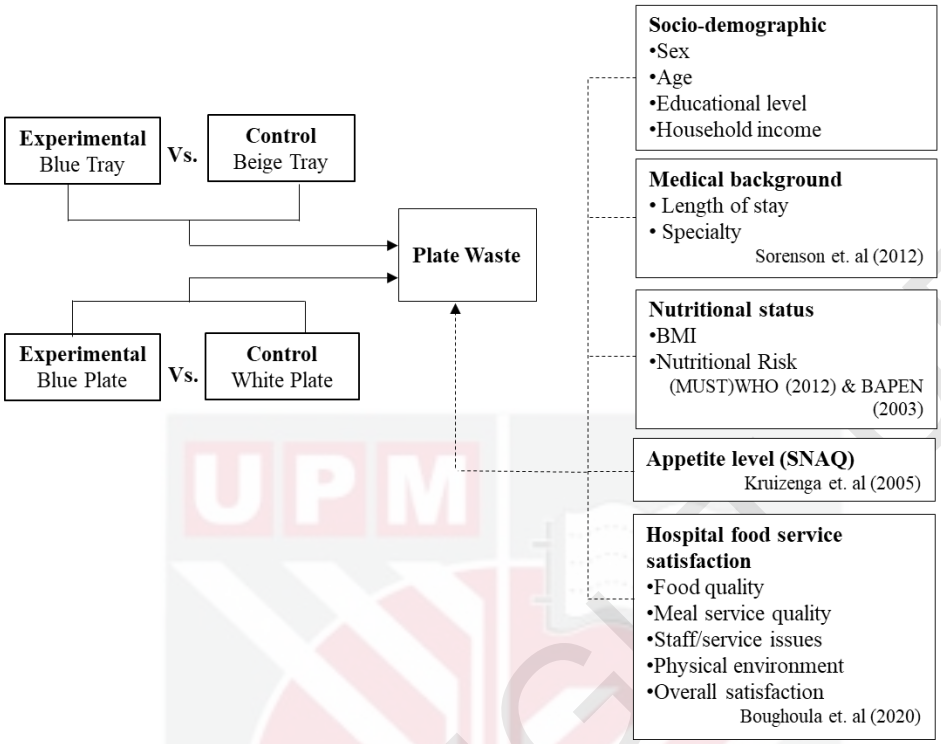

Figure 1.1: Conceptual Framework

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